

Gov. Doc

Canada. Sheet Metal Trade, National Committee on the

CAI

L 9

- 57A57

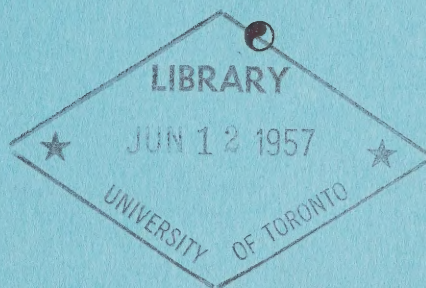
< General publication >

< G-1 >

AN ANALYSIS

OF THE

SHEET METAL TRADE



PREPARED BY

A NATIONAL COMMITTEE

APPOINTED BY

THE DEPARTMENT OF LABOUR

OTTAWA, CANADA

1957

CAL 9
-57A57

AN ANALYSIS
OF THE
SHEET METAL TRADE

PREPARED BY
A NATIONAL COMMITTEE
APPOINTED BY
THE DEPARTMENT OF LABOUR
OTTAWA, CANADA

1957



Digitized by the Internet Archive
in 2022 with funding from
University of Toronto

<https://archive.org/details/31761117666438>

AN ANALYSIS OF THE SHEET METAL TRADE

TABLE OF CONTENTS

A. INTRODUCTION

B. DIVISIONS OF THE ANALYSIS

BLOCK 1 - Basic Science and Shop Practice	Page 1
BLOCK 2 - Pattern Development	Page 2
BLOCK 3 - Methods of Cutting	Page 6
BLOCK 4 - Forming Procedures	Page 9
BLOCK 5 - Methods of Joining	Page 15
BLOCK 6 - Assembly and Erection Techniques	Page 21

C. BIBLIOGRAPHY

Page 30

COMMITTEE

Chairman: S. P. Didcote

Member: O. Peters

Member: T. Morrison

AN ANALYSIS OF THE SHEET METAL TRADE

INTRODUCTION

It was recommended at the first National Conference on Apprenticeship in Trades and Industry, held in Ottawa in May 1952, that the Federal Government be requested to co-operate with Provincial Apprenticeship Committees and those concerned with Apprenticeship Training, in preparing a number of trade analyses in certain skilled occupations.

In December 1955, the Training Branch, Department of Labour, Ottawa, appointed Mr. B.F. Addy, M.A., Principal, Manitoba Technical Institute, Winnipeg, to act as co-ordinator and to select a committee to prepare an Analysis of the Sheet Metal Trade. The Committee was organized in January, 1956, and consisted of Mr. S. P. Didcote, Department Head, Manitoba Technical Institute, Chairman; Mr. Otto Peters, Supervisor of Metal Crafts, Technical Vocational High School, Winnipeg; and Mr. T. Morrison, Sheet Metal Instructor, Manitoba Technical Institute.

SCOPE OF THE ANALYSIS

The analysis contains only those phases of the trade considered essential in all provinces. This leaves each province free to add to the analysis any skills or knowledge peculiar to its particular area. The analysis is not intended to be a course of study, and accordingly the operations need not necessarily be taught in the sequence set forth.

While the scope of the analysis is quite comprehensive, embracing as it does, the manipulative features of the trade with necessary related knowledge, it does view the trade in its broader aspects and includes blueprint reading, mathematics and science. In addition to this, the committee suggests that the trainee be given, when opportunity affords, an introduction to certain phases of estimating and also of design which involves proportioning sizes and determining capacities and the like.

PROCEDURE

To ensure that the analysis would be nationally acceptable, a Referee was appointed in each province to comment on the details of the work as it proceeded. A second draft was then prepared after due consideration had been given to the comments received by the Committee. It was agreed that each referee secure formal approval of the final analysis by the appropriate provincial advisory committee and other authorities.

AN ANALYSIS OF THE SHEET METAL TRADE

INTRODUCTION

The analysis is composed of a series of Blocks, each of which is a group of related units. Each unit is divided into a series of operations with the necessary related knowledge indicated. References to Safety are taken from the "Code of Construction Safety Measures", Part 8 of the National Building Code 1953 by the National Research Council Canada, Bulletin 2903. This bulletin deals with knots, slings, rigging, scaffolds, ladders and general safety practices.

USE OF THE ANALYSIS

This analysis is recommended as (i) a basis for training programs in industry, courses of study in vocational schools, trades institutes, etc., (ii) a guide to foremen for on-the-job training, (iii) a basis on which experience may be evaluated, (iv) a means of transferring apprenticeship credits from one province to another.

It is the sincere hope of the committee that this effort will contribute to the nation-wide development of apprenticeship training and that it will be accepted as a standard of attainment for the granting of completion certificates to apprentices and certificates of qualification to experienced craftsmen.

The committee desires to express its appreciation to officials of the Training Branch of the Department of Labour, Ottawa, for their co-operation and guidance. Thanks are also due to the Regional Directors and referees in the various provinces who rendered assistance in this project.

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 1: Basic Science and Shop Practice

TABLE OF CONTENTS

UNIT 1: Elementary Drafting:

This unit is intended to familiarize the trainee with the use of drafting instruments and introduce him to drafting procedures having particular importance in this trade.

UNIT 2: Mathematics:

- (a) Mensuration used in finding length of lines, areas, volumes, and the like
- (b) Geometry of angles, triangles and various figures in production problems

UNIT 3: Science:

- (a) Metallurgy of various trade materials, e.g. iron, steel, tin, zinc, lead, solder
- (b) Methods of weather and rust-proofing

UNIT 4: Trade Specifications:

- (a) Names, sizes and dimensions, gauges, weights
- (b) How to order repairs, supplies and common materials
- (c) Use of manuals, handbooks and trade literature

UNIT 5: Codes: National and Local

- (a) Safety
- (b) Heating and Ventilating
- (c) Building.

UNIT 6: Care and use of all hand and bench tools, power tools and shop equipment

NOTE: The content of the above mentioned units is of a general nature and for this reason no sheets in detail are included in the analysis. Some of these topics are included throughout the text where they apply.

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 2: Pattern Development by Various Methods

TABLE OF CONTENTS

UNIT 1: Parallel Method	Page 3
Operation 1: Developing patterns for profile forms	
2: Developing patterns for rectangular forms	
3: Developing patterns for round and elliptical forms	
UNIT 2: Radial Line Method	Page 4
Operation 1: Developing patterns for regular tapering forms	
2: Developing patterns for pyramids	
UNIT 3: Triangulation Method	Page 5
Operation 1: Developing patterns for irregular tapered forms	
2: Developing patterns for transitions	
3: Developing patterns for double angle forms	

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 2: Pattern Development

UNIT 1: Parallel Line Method

OPERATIONS	KNOWLEDGE
1. Developing patterns for profile forms	(a) Blueprint reading to determine size and profile (b) Methods of obtaining stretchout patterns (c) Allowance for seams, folds and joints (d) Methods of determining miter line (e) Types of notches
2. Developing patterns for rectangular forms	(a) Blueprint reading to determine size and profile (b) Mathematics: Perimeters
3. Developing patterns for round and elliptical forms	(a) Blueprint reading to determine size and profile (b) Mathematics: Circumferences of circle and ellipse

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 2: Pattern Development

UNIT 2: Radial Line Method

OPERATIONS	KNOWLEDGE
1. Developing patterns for regular conical forms	(a) Blueprint reading to determine size and profile (b) Types of conical forms (c) Plan and elevation relationship (d) Method of determining the apex (e) Method of developing the pattern (f) Seam allowance (g) Types of notches
2. Developing patterns for pyramids	(a) Blueprint reading to determine size and profile (b) Types of pyramid forms

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 2: Pattern Development

UNIT 3: Triangulation Method

OPERATIONS	KNOWLEDGE
1. Developing patterns for irregular tapered forms	<ul style="list-style-type: none"> (a) Blueprint reading to determine form and size (b) Types of tapered forms (c) Plan and elevation relationship to half-pattern (d) Method of determining solid and broken lines (e) Method of determining the hypotenuse of the triangle for true lengths (f) True length relationship in the stretch-out (g) Seam and lock allowances (h) Types of notches (i) Mathematics: Geometry of the right angled triangle
2. Developing patterns for transitions	<ul style="list-style-type: none"> (a) Blueprint reading to determine offset forms and sizes (b) Types of transitions (c) Plan and elevation relationship for full pattern
3. Developing patterns for double angle forms	<ul style="list-style-type: none"> (a) Blueprint reading to determine true angle of auxiliary forms (b) Types of twisted shapes (c) Plan, elevation and auxiliary views and double auxiliary views

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 3: Methods of Cutting

TABLE OF CONTENTS

UNIT 1: Straight Shearing Page 7

- Operation 1: Straight hand shearing
- 2: Slitting
- 3: Split shearing
- 4: Square shearing
- 5: Making an inside cut
- 6: Shearing with a cold chisel

UNIT 2: Curved Shearing Page 8

- Operation 1: Curved hand shearing
- 2: Circle shearing
- 3: Making an inside cut
- 4: Shearing compound curves

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 3: Methods of Cutting

UNIT 1: Straight Shearing

OPERATIONS	KNOWLEDGE
1. Straight hand shearing	(a) Use of hand shears, regular and combination pattern (b) Safety - Section 8.2.1. - 8.2.2. - 8.2.3.
2. Slitting	(a) Use of hand shears and special slitting shears (b) Use of lever slitting shears (c) Use of hand and power operated rotary splitting shears (d) Use of portable electric unishear or nibblex (e) Safety - Section 8.6.8. - 8.14.
3. Split shearing	(a) Use of double-cut pipe shears
4. Square shearing	(a) Use of foot and power operated squaring shears and attachments (b) Use of foot and power operated gap squaring shears
5. Making an inside cut	(a) Methods of starting an inside cut (b) Use of bench and slitting shears (c) Use of scroll shears
6. Shearing with a cold chisel	(a) Use of cold chisel for shearing rivets, bolts, etc.

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 3: Shearing

UNIT 2: Curved Shearing

OPERATIONS	KNOWLEDGE
1. Curved Hand Shearing	(a) Use of hand shears, special types
2. Circle Shearing	(a) Use of hand and power operated circle shears
3. Making an Inside Cut	(a) Use of hand and power operated, ring and circle shears
4. Shearing Compound Curves	(a) Use of power operated elbow shear

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 4: Forming Procedures

TABLE OF CONTENTS

UNIT 1: Edges formed by bench tools	Page 10
Operation 1: Hem edging	
2: Open edging	
3: Burring	
4: Turning	
5: Flanging	
6: Crimping	
UNIT 2: Shapes formed by hand and bench tools	Page 11
Operation 1: Rolling	
2: Forming on stakes	
3: Profile bending	
4: Panning	
5: Raising, bumping and stretching	
UNIT 3: Beading and swaging	Page 12
Operation 1: Beading	
2: Swaging	
UNIT 4: Wired edges	Page 13
Operation 1: Wiring a straight edge	
2: False wiring on edges of containers	
UNIT 5: Reinforcements	Page 14
Operation 1: Diagonal bending	
2: Reinforcing	

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 4: Forming Procedures

UNIT 1: Edges Formed by Bench Tools

OPERATIONS	KNOWLEDGE
1. Hem Edging	(a) Types and uses of hemmed edges (b) Allowance for hem edge (c) Methods of closing hemmed edges (d) Use of brake and bar folder
2. Open Edging	(a) Types and uses of open edges (b) Allowance for open edges (c) Use of brake, bending bar and bar folder
3. Burring	(a) Types of burrs and wheel sizes (b) Methods of burring (c) Allowance for burr (d) Use of hand and power burring equipment
4. Turning	(a) Size of turning wheels (b) Methods of turning edges (c) Allowance for turned edge (d) Use of hand and power turning equipment
5. Flanging	(a) Types and uses of flanges (b) Methods of flanging (c) Use of hand and power flanging equipment
6. Crimping	(a) Reasons for crimped edges (b) Use of hand and power crimping equipment

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 4: Forming Procedures

UNIT 2: Shapes Formed by Hand and Bench Tools

OPERATIONS

KNOWLEDGE

- | | |
|------------------------------------|--|
| 1. Rolling | (a) Types of rolled forms
(b) Use of solid or slip rolls and funnel forming equipment |
| 2. Forming on Stakes | (a) Various types of stakes
(b) Use of each type of forming stake
(c) Use and kinds of hand tools used with each type of stake |
| 3. Profile Bending | (a) Types of profiles and forms
(b) Use of hand and/or power cornice brake |
| 4. Panning | (a) Methods of panning
(b) Use of panning equipment |
| 5. Raising, Bumping and Stretching | (a) Types and uses of bumping hammers and dies
(b) Types and uses of stretching hammers and dies
(c) Method of determining layout for bumping
(d) Science: (i) Yield point of metal
(ii) Annealing metal |

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 4: Forming Procedures

UNIT 3: Beading & Swaging

OPERATIONS	KNOWLEDGE
1. Beading	(a) Types of beading rolls (b) Methods of reinforcing with beads (c) Use of hand and power beading equipment
2. Swaging	(a) Types of swaging rolls (b) Methods of swaging to act as stops and reinforcements (c) Use of hand and power swaging equipment

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 4: Forming Procedures

UNIT 4: Wired Edges

OPERATIONS	KNOWLEDGE
<hr/>	
1. Wiring a Straight Edge	(a) Allowance for wired edge (b) Wire sizes and guages (c) Use of wire guage and micrometer (d) Use of hand and power wiring equipment (e) Use of hand and power wire and brace bending equipment
2. False Wiring on Edges of Round, Rectangular or Square Containers	(a) Allowance for false wire (b) Use of hand and power false-wiring and turning equipment

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 4: Forming Procedures

UNIT 5: Reinforcements

OPERATIONS	KNOWLEDGE
1. Diagonal Bending	(a) Methods and use of diagonal bends for stiffening
2. Reinforcing	(a) Methods of reinforcing with band iron (b) Methods of reinforcing with angle iron (c) Methods of reinforcing with tee iron (d) Methods of reinforcing with channel iron (e) Methods of fastening reinforcements

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 5: Methods of Joining

TABLE OF CONTENTS

UNIT 1: Lock Seams	Page 16
Operation 1: Groove seaming	
2: Setting down and peening	
3: Double seaming	
4: Box locking	
5: Pittsburgh locking	
6: Elbow edging	
7: Elbow seam closing	
8: Standing seam	
9: Collar locking	
UNIT 2: Riveted Seams	Page 18
Operation 1: Punching holes	
2: Drilling	
3: Riveting	
UNIT 3: Welding	Page 19
Operation 1: Spot welding	
2: Acetylene welding	
3: Arc welding	
UNIT 4: Soldering	Page 20
Operation 1: Heating the soldering copper	
2: Forging the soldering copper	
3: Tinning the soldering copper	
4: Fluxing	
5: Applying the solder	
6: Finishing soldered joints	

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 5: Methods of Joining

UNIT 1: Lock Seams

OPERATIONS	KNOWLEDGE
1. Groove Seaming	(a) Groove seam allowance (b) Various groove widths (c) Internal and external seams (d) Use of hand and machine groovers (e) Brake mallet and stake grooved seam
2. Setting Down and Peening	(a) Methods of setting down and peening (b) Use of hand and power setting down equipment
3. Double Seaming	(a) Location and types of double seams (b) Allowance for double seaming (c) Use of hand and/or power double seaming equipment
4. Box Locking	(a) Methods of forming box locks (b) Allowance for box lock (c) Location of box locks
5. Pittsburgh Locking	(a) Allowance for Pittsburgh lock (b) Use of brake and Pittsburgh lock former (c) Methods of locking
6. Elbow Edging	(a) Types of elbow edging rolls (b) Allowance for elbow edging (c) Use of hand and power elbow edging machines
7. Elbow Seam Closing	(a) Methods of closing seam for rigid or adjustable elbows (b) Methods of closing seams (c) Use of hand and machine closing equipment

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 5: Methods of Joining

UNIT 1: Lock Seams

OPERATIONS	KNOWLEDGE
8. Standing Seam	(a) Types of standing seams (b) Allowances for standing seams (c) Types of fastening devices used with standing seams (d) Use of standing seam closing devices
9. Collar Locking	(a) Types of collar locks (b) Methods of locking collars (c) Allowances for various locks (d) Use of hand and power collar locking equipment

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 5: Methods of Joining

UNIT 2: Riveted Seams

OPERATIONS	KNOWLEDGE
1. Punching Holes	(a) Method and rules for hole spacing (b) Use of hand and power punching equipment (c) Types of punching equipment (d) Mathematics: (i) Decimals (ii) Micrometer
2. Drilling	(a) Types of drilling equipment (b) Number, letter and fractional drill sizes (c) Drill angles and clearances (d) Use of hand and power drilling equipment
3. Riveting	(a) Method of sizing rivets (b) Types of rivets (c) Methods of setting and heading (d) Types of rivet bolsters (e) Use of hand and power riveting equipment

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 5: Methods of Joining

UNIT 3: Welding

OPERATIONS	KNOWLEDGE
1. Spot Welding	(a) Methods of preparing the material (b) Location and spacing of the welds (c) Types of welders, tips and polarity (d) Metal thickness and amperage settings (e) Use of portable and/or stationary spot welding equipment (f) Safety: 8.6.7. (g) Science: (i) Metals and alloys (ii) Melting points, heat transfer (iii) Oxidation (iv) Fusion, penetration and adhesion
2. Acetylene Welding	(a) Types of joints (b) Types of flame and gas mixture (c) Various positions (d) Methods of preparing material (e) Allowances (f) Science: Oxidization and carbonization
3. Arc Welding	(a) Polarity and current requirements (b) Types of welding equipment (c) Science: Penetration

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 5: Methods of Joining

UNIT 4: Soldering

OPERATIONS	KNOWLEDGE
1. Heating the Soldering Copper	(a) Methods and equipment for heating soldering coppers (b) Methods of determining proper soldering temperature
2. Forging the Soldering Copper	(a) Various types and shapes of soldering coppers (b) Weights of soldering coppers (c) Use of hammer and anvil for forging
3. Tinning the Soldering Copper	(a) Need for cleaning surfaces that require tinning (b) Use of dip or tinning solutions
4. Fluxing	(a) Flux: Types and uses (b) Application of various fluxes (c) Methods and reason for defluxing after soldering (d) Safety: Handling of acids (e) Science: Acids, bases and salts, and their action
5. Applying the Solder	(a) Types and uses of various solders (b) Solder flow and penetration (c) Preheating when necessary (d) Methods of applying solder to various types and positioned joints (e) Methods of testing for leaks (f) Methods of tinning surfaces
6. Finishing Soldered Joints	(a) Knowledge of filing, sanding and buffing procedures (b) Use of hand and power equipment (c) Use of different necessary supplies

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 6: Assembly and Erection Techniques

TABLE OF CONTENTS

UNIT 1: Gutters and Downspouts	Page 23
Operation 1: Assembling gutters	
2: Assembling downspouts	
3: Hanging gutters	
4: Hanging downspouts	
UNIT 2: Gravity Heating	Page 24
Operation 1: Laying out the heating system	
2: Roughing-in	
3: Casing the heating units	
4: Installing round pipes	
UNIT 3: Forced Air Heating	Page 25
Operation 1: Installing fans, blower & heating unit	
2: Installing plenums, rectangular ducts and fittings	
3: Installing dampers	
4: Installing controls	
5: Installing humidifiers	
UNIT 4: Ventilating	Page 26
Operation 1: Installing gravity ventilators	
2: Insulating ventilating systems	
3: Installing mechanical ventilation	
4: Installing louvres and shutters	
UNIT 5: Roofing	Page 27
Operation 1: Undercoating	
2: Laying roof sheets	
3: Applying capping	

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 6: Assembly and Erection Techniques

UNIT 6: Flashing and Coping Page 28

- Operation 1: Applying step flashing
- 2: Applying cover flashing
- 3: Applying hip and valley flashing
- 4: Applying coping
- 5: Water-proofing
- 6: Installing roof hoppers

UNIT 7: Skylights Page 29

- Operation 1: Assembling curbs and condensation gutters
- 2: Assembling skylight bars
- 3: Assembling gable ends
- 4: Installing skylight sash
- 5: Setting skylights

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 6: Assembly & Erection Techniques

UNIT 1: Gutters & Downspouts

OPERATIONS	KNOWLEDGE
<hr/>	
1. Assembling Gutters	(a) Sizes and styles of gutters (b) Methods of producing miters and odd forms (c) Types of ends (d) Types of drops (e) Methods of joining drops and ends (f) Expansion joints (g) Science: Rust inhibitors (h) Safety: 8.9.
2. Assembling Downspouts	(a) Sizes and styles of downspouts (b) Types and uses of fittings and cutoffs (c) Types of headers
3. Hanging Gutters	(a) Types of ladder brackets and scaffolds (b) Types of hangers, spikes and ferrules (c) Methods of hanging (d) Amount and methods of inclination (e) Methods of water-proofing (f) Standard building construction
4. Hanging Downspouts	(a) Types of bands and hooks (b) Methods of draining (c) Methods of fastening

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 6: Assembly and Erection Techniques

UNIT 2: Gravity Heating

OPERATIONS	KNOWLEDGE
1. Laying out the Heating System	<ul style="list-style-type: none">(a) Blueprint reading to determine details of building construction(b) Methods of determining register sizes and placement(c) Methods of determining heating unit size(d) Use of national warm air heating code(e) Types of gravity heating systems(f) Science: Standard of heat measurement and infiltration
2. Roughing-in	<ul style="list-style-type: none">(a) Blueprint reading to locate warm and return air openings(b) Symbols for warm and return air openings(c) Types and methods of installing wall boxes(d) Types and methods of installing stacks and headers(e) Methods of lining return air joists and openings(f) Types and sizes of warm and return air registers or grilles
3. Casing the Heating Units	<ul style="list-style-type: none">(a) Types of casings(b) Use and types of liners(c) Use and types of baffles(d) Methods of securing casings, liners and baffles(e) Types of furnace bonnets(f) Science: <ul style="list-style-type: none">(i) Heat radiation(ii) Converting Centigrade to Fahrenheit
4. Installing Round Pipes	<ul style="list-style-type: none">(a) Standard pipe sizes and fittings(b) Types and placement of warm and return air collars(c) Methods of securing collars(d) Methods of hanging and securing pipes(e) Methods of sealing pipe and fitting joints(f) Pitch of warm and return air pipes(g) Smoke pipe and check damper installation(h) Down draft diverters(i) Requirements of local and national heating codes

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 6: Assembly and Erection Techniques

UNIT 3: Forced Air Heating

OPERATIONS	KNOWLEDGE
<hr/>	
1. Installing Fans, Blowers and Heating Unit	(a) Fan sizes and capacities (b) Anti-vibration fan mountings and connections (c) Air filters, washers and dust stops (d) Airflow symbols (e) Air circulation (f) Science: Determining air velocity
2. Installing Plenums, Rectangular Ducts and Fittings	(a) Types and methods of installing plenums (b) Types of rectangular fittings (c) Types of turn vanes and deflectors (d) Types of ducts and construction of same (e) Methods of installing ducts (f) Use and types of S-clips and drive cleats (g) Trunk and individual duct systems (h) Zone duct systems (i) Principles of perimeter, panel and airwall heating (j) Duct coverings
3. Installing Dampers	(a) Methods of installing dampers (b) Types of dampers and switches (c) Methods of controlling dampers
4. Installing Controls	(a) Types and use of thermostats (b) Types and use of furnacestats (c) Types and use of zone controls (d) Damper switch controls (e) Types and use of humidity controls (f) Types and use of barometric controls (g) Use of efficiency testing equipment (h) Science: Determining CO ₂ percentage
5. Installing Humidifiers	(a) Types of steam humidifiers (b) Types of water humidifiers (c) Placement of humidifiers (d) Science: Relative humidity (e) Requirements of local and national heating codes

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 6: Assembly and Erection Techniques

UNIT 4: Ventilating

OPERATIONS	KNOWLEDGE
<hr/>	
1. Installing Gravity Ventilators	(a) Types of gravity ventilators (b) Methods of installing ventilators (c) Location of gravity ventilators (d) Science: Condensation
2. Insulating Ventilating Systems	(a) Types and reasons for insulating ducts and ventilators (b) Methods of securing insulation to ducts and ventilators (c) Science: Principles of insulation
3. Installing Mechanical Ventilation	(a) Types of ventilating fans (b) Methods of installing ventilating fans (c) Sizes and capacities of ventilating fans (d) Air changes and recirculation (e) Placement of fresh air intakes (f) Types and uses of air mixing chambers
4. Installing Louvers and Shutters	(a) Types and uses of automatic shutters (b) Types and uses of mechanically operated louvers (c) Placement and size of louvers and shutters

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 6: Assembly and Erection Techniques

UNIT 5: Roofing

OPERATIONS	KNOWLEDGE
1. Undercoating	(a) Blueprint reading to determine type of underlay and undercoating (b) Method of applying undercoating (c) Safety: 8.8.11 (d) Mathematics: Mensuration to determine areas and quantities
2. Laying Roof Sheets	(a) Blueprint reading to determine material, gauges and sizes (b) Types of roofs and covering materials (c) Types of starter sheets (d) Methods of joining sheets (e) Devices for securing roofing (f) Methods of finishing and securing outer edges (g) Uses of various roofing tools and equipment (h) Science: (i) Expansion and contraction (ii) Electrolysis
3. Applying Capping	(a) Blueprint reading to determine type of capping (b) Types and styles of capping (c) Methods of applying capping for various roofs

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 6: Assembly and Erection Techniques

UNIT 6: Flashing and Coping

OPERATIONS	KNOWLEDGE
1. Applying Step Flashing	(a) Method of applying step flashing against walls of various materials (b) Methods of securing steps
2. Applying Cover Flashing	(a) Types of cover flashing (b) Methods of securing flashing (c) Function of cover flashing
3. Applying Hip and Valley Flashing	(a) Types and placement of hip and valley flashing (b) Methods of securing angle and valley flashing
4. Applying Coping	(a) Function and types of coping (b) Methods of bracing and securing (c) Science: Expansion
5. Water-Proofing	(a) Methods of water-proofing (b) Uses of water-proofing equipment
6. Installing Roof Hoppers	(a) Types of gravel stops (b) Methods of securing hoppers

AN ANALYSIS OF THE SHEET METAL TRADE

BLOCK 6: Assembly and Erection Techniques

UNIT 7: Skylights

OPERATIONS	KNOWLEDGE
<hr/>	
1. Assembling Curbs and Condensation Gutters	(a) Types of curbs (b) Methods of assembling curbs (c) Types of condensation gutters (d) Methods of draining (e) Methods of fastening gutters (f) Use of roofing square
2. Assembling Skylight Bars	(a) Blueprint reading to determine bar dimensions and spacing (b) Types and methods of securing ridge bars (c) Types and methods of securing common bars (d) Types and methods of securing hip bars (e) Types and methods of securing jack bars (f) Types and methods of securing sash bars and caps
3. Assembling Gable Ends	(a) Types and methods of securing gable ends
4. Installing Skylight Sash	(a) Types of ventilator bases (b) Types of skylight sash (c) Methods of pivoting sash (d) Methods of raising sash (e) Types of sash locking hardware
5. Setting Skylights	(a) Securing skylight curb to various type roofs (b) Methods of finishing skylight openings

AN ANALYSIS OF THE SHEET METAL TRADE

BIBLIOGRAPHY

<u>Title</u>	<u>Author</u>	<u>Publisher</u>
1. Sheet Metal Shop Practice	L. F. Bruce	American Technical Society
2. Students Text on Sheet Metal Work	D. A. Graham	Scott Publishing Co.
3. Sheet Metal Pattern Drafting	F. L. Ogilvie	Sheet Metal Publishing Co.
4. Sheet Metal Pattern Drafting	F. J. O'Rourke	McGraw Hill Book Co. Inc.
5. Sheet Metal Workers Instructor	R. H. Warn & I.G. Horner	General Publishing Co. Ltd.
6. Sheet Metal Workers Manual	L. Broemel	General Publishing Co. Ltd.
7. Code of Construction Safety Measures	National Research Council	Ottawa
8. The Universal Sheet Metal Pattern Cutter Vol. I	William Neubecker	Sheet Metal Publication Co.
9. Heating & Ventilating	Oscar Faber	British Book Service
10. Sheet Metal Mathematics	N.Y.S.V.P.A.A. Publication	Delmar Publishers
11. Measurement and Layout	N.Y.S.V.P.A.A. Publication	Delmar Publishers
12. Hand Processes	N.Y.S.V.P.A.A. Publication	Delmar Publishers
13. Machine Processes	N.Y.S.V.P.A.A. Publication	Delmar Publishers
14. Successful Soldering	Louies Taylor	McGraw Hill Book Co. Inc.
15. Air Conditioning Metal Layout	Joseph J. Kaberlein	Bruce Publishing Co.
16. Elements of Sheet Metal Work	R. L. Welch	Bruce Publishing Co.
17. Sheet Metal Pattern Layout	Edwin P. Anderson	General Publishing Co. Ltd.
18. Sheet Metal Work	William Neubecker	American Technical Society
19. Sheet Metal Workers Handy Book	Frank D. Graham & Edwin Anderson	
National Warm Air Heating and Air Conditioning Manuals No. 3, No. 4, No. 5, No. 7, No. 9, No. 10 and Manual A 1957 (Canadian)		National Warm Air Heating and Air Conditioning Association

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1957.